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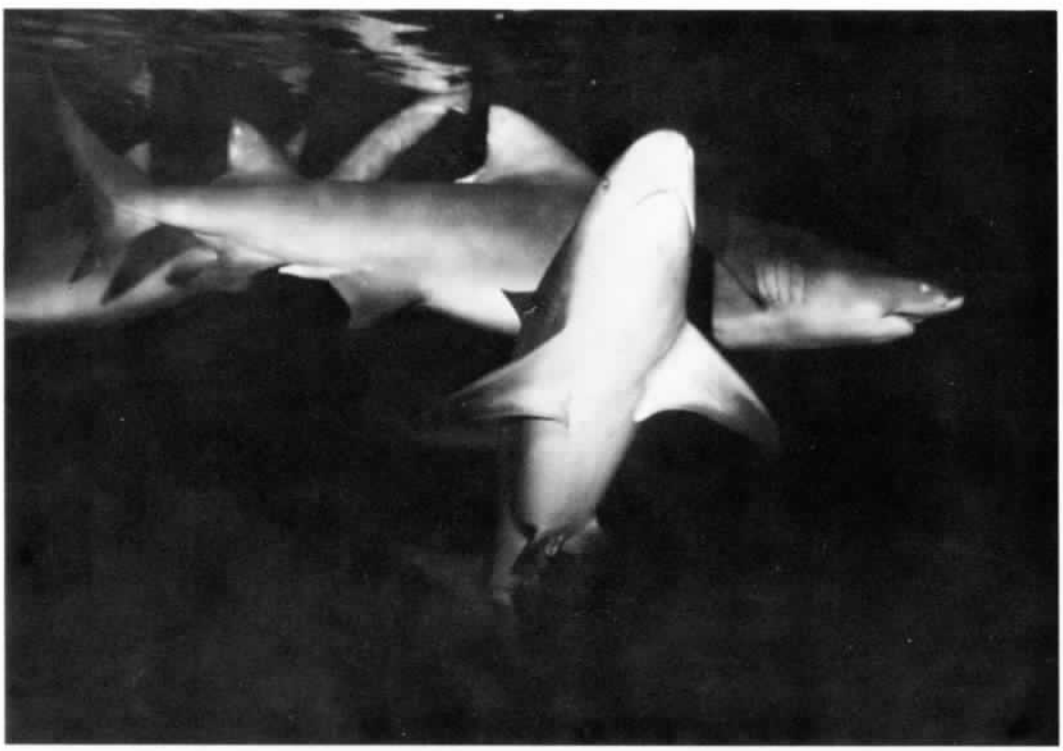

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CONTENTS

COVER: Stereotyped predictable behavior of a bull shark, *Carcharhinus leucas*. The bull shark is seen beneath an Atlantic lemon shark, *Negaprion brevirostris*. These sharks were photographed in captivity by David M. Stalls.

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Five Insects Believed to be Newly Established or Recolonized on Santa Cruz Island, California (Dermaptera, Lepidoptera)

Jerry A. Powell

Abstract.—Five insects believed to be newly established or recolonized on Santa Cruz Island, California (Dermaptera, Lepidoptera) by Jerry A. Powell, *Bull. Southern California Acad. Sci.*, 79(3):97–108, 1980. An earwig, 2 moths, and 2 butterflies not recorded in 1939–41 and 1966–69 surveys of S.C.I. insects, became established during 1969–78. Evidence suggests that 3 were introduced by man. Sudden appearance of the butterflies, however, is not easily interpreted. Either might have immigrated often during 50–100 years S.C.I. has had their weedy hostplants. It is hypothesized that such species periodically colonize, are eliminated during stress such as overgrazing by feral sheep in drought years, then recolonize. An undersaturated nature of the insect fauna of offshore islands, especially badly perturbed ones, is proposed. Extinction presumably is higher than natural, immigration low, and/or colonization improbable owing to reduced patch sizes of native hostplants.

University of California, 201 Wellman Hall, Berkeley, California 94720.

Santa Cruz Island (S.C.I.) is the largest of the northern tier of California's Channel Islands and is the most diverse geographically and faunistically. Lying 30 km off the coast of the mainland, about 40 km south of Santa Barbara, the island is approximately 34 km long, ranging from 3 to 10 km wide, with an area of ca. 249 km^2.

There is no record of the native insect fauna prior to extensive disturbance of the natural flora by feral sheep and pigs. Sheep and hogs may have been introduced in the early 1800s. Cattle were grazed on the island as early as 1865 (Hillinger 1958), and according to Holder (1910) the Caire ranch was managing more than 30,000 head of sheep around the turn of the century. During the early era of insect exploration in California (1860–1930) inaccessibility of the Channel Islands and ownership visitation policies discouraged collecting visits. Sporadic survey by entomologists and sporadic collections by other biologists were made during the late 1800s and after the turn of the century, but most of these were on Santa Catalina and San Clemente Islands (see Miller and Menke 1980, for review of entomological investigations). No comprehensive systematic list of insects was produced for S.C.I. from these early visits. Even on the one major, organized Channel Islands survey, that of the Los Angeles County Museum in 1939–41, Santa Cruz Island was relatively neglected, considering its size, with only a one-week visit in August (with 3 entomologists), and a 5 day visit in March, mainly at Pelican Bay by one entomologist, with some collecting at other sites by two persons (Comstock 1939, 1946). Therefore extensive overgrazing had taken place for 80 years or more before any appreciable insect survey occurred.

A cooperative effort, beginning in 1940, between the Stanton family, owners

of the island, and the Department of Biological Control, University of California, Riverside, to control prickly pear cactus, preceded the establishment of the U.C. Santa Cruz Island Reserve and field station on the Stanton property. According to Goeden et al. (1967), Mr. Stanton estimated that approximately 40% of the rangeland of the island had been rendered useless for grazing by dense growth of native prickly prears. After 24 years of efforts involving releases of several native southwestern Nearctic species of Hemiptera, Homoptera and Lepidoptera, a considerable degree of control was effected, primarily by cochineal scales, *Dactylopius* (Goeden et al. 1967).

Presence of the field station, beginning in 1966, opened the door for much more diverse and intensive entomological survey work, so that a picture of the island's insect fauna has begun to emerge during the past 15 years. In general the insect fauna has been found to be depauperate relative to that of the mainland (Powell 1967; Miller 1971; Opler 1974; Weissman and Rentz 1976). For example, only 33 species of butterflies have been discovered in rather intensive search during all months of the year (Langston 1980; C. L. Remington pers. comm.; California Insect Survey unpubl. data), while more than twice that number occur in a comparable area of adjacent mainland around Santa Barbara (Emmel and Emmel 1973; S. Miller in litt.). The fauna contains only a few endemic species (Alexander 1973; Gordon 1976; Powell 1967; Opler 1971, 1977; Rentz and Weissman 1973). Probably those mostly are relics of past extensive mainland distributions, as is believed to be true of endemic plants (Thorne 1969). However, Rentz and Weissman (1973) give evidence for island speciation in one genus of sand-burrowing crickets.

The establishment of a U.S. Naval operation on the island in the 1940s—and later the field station—has caused a considerable increase in the traffic of personnel, foodstuffs, and equipment in recent decades. As a result, the chance of introduction and establishment of mainland species has increased. Five species appear to have become established on the island during the past 15 years, based on survey work carried out in 1966–1969 compared with more recent collections.

No doubt the insects of Santa Cruz Island are incompletely surveyed, but comparison of collections from different institutions indicates that there has been sufficient seasonal coverage to enable reasonable confidence in statements about easily obtained species. Additions to the faunal list are expected in taxa where the insects are small or require specialized collection techniques (e.g., Berlese samples of litter dwellers, rearing of leaf miners, etc.), but the appearance of previously unrecorded, yet easily observed species can be taken as evidence of recent establishment or expansion of populations on the island.

During 1966 and 1969, personnel of the California Insect Survey, University of California, Berkeley, made three general collecting trips to the island. The first, 25 April to 2 May, involved 6 staff and graduate students, who devoted approximately 36 Full Time Equivalent (FTE) collector days. The second, 7–10 June 1966, was made by two participants, an equivalent of 8 FTE days. The third trip took place 14–17 March 1969, with 5 experienced collectors, about 15 FTE days. All three visits were blessed with good weather and adequate transportation facilities so that diverse habitats were surveyed, from Christi Beach near the western end to the vicinity of Chinese Harbor in the northeastern portion of the island. Subsequent collecting has shown that many species were overlooked, especially

those active as adults only in late summer, fall, and winter. However, five species encountered during the 1970s are insects that likely would have been observed during our 1960s trips had they been present, as documented below.

DERMAPTERA

Forficula auricularia (Linnaeus)

Although the European earwig was not discovered in California before 1923, it rapidly spread throughout the northern half of the state at low to moderate elevations during the 1930s. The earliest record in southern California was 1931, but the species was not considered established there until 1940 or later (Langston and Powell 1975). It was collected around Santa Maria during 1945–1947 and at Santa Barbara as early as 1952, but we were unable to document its established occurrence in the 1960s for most of southern California (Langston and Powell 1975). Only one record was known from the Channel Islands at that time, a collection in 1972 on San Clemente Island.

Langston and I made special efforts to look for earwigs on both of our 1966 trips to Santa Cruz Island, as this was during the data-gathering years for the C.I.S. bulletin. Searches were made around the ranch buildings, the vegetable garden, and other likely sites, but we found no Dermaptera.

In September 1978, M. E. Buegler and I found adults and immatures of *Forficula* common around the field station. Therefore it appears that the European earwig was introduced to S.C.I. during the 1970s. Similarly, this earwig has recently turned up on Santa Rosa Island, the earliest specimen having been collected in 1971 (Langston and Miller 1977). That it was not introduced earlier to either island probably can be attributed to the fact that *F. auricularia* is better adapted to more mesic, northern habitats in California than arid ones. As a result this insect is not as abundant in southern California as is the ring-legged earwig, *Euborellia annulipes* (Gerstaecker), and probably it was not established in mainland areas adjacent to the islands before the 1950s or later.

Euborellia annulipes, a wingless species, has been widely established in southern California since the 1880s and is known from several of the Channel Islands, but still has not been discovered on S.C.I. (Langston and Powell 1975; Langston and Miller 1977). Although earwig colonies may be overlooked owing to seasonal dormancy or other causes of restricted occurrence, the flightless *E. annulipes* is more likely to remain localized and therefore undiscovered than is *Forficula*.

LEPIDOPTERA

Pieris rapae (Linnaeus)

The cabbage white butterfly occurs abundantly throughout California, except at the highest elevations and in the deserts, and is particularly common in coastal urban and agricultural situations. It is an Old World insect that was introduced into eastern North America about 1860 and is believed to have spread rapidly across the country (Holland 1898; Wright 1906). There is a possibility that it was introduced separately into California. In any event, *P. rapae* has been established in southern California coastal areas since before the turn of the century, the first specimen having been taken in 1883 (Wright 1906). Thus it was surprising when we did not find this species on Santa Cruz Island in 1966. Each trip included two

lepidopterists, and other collectors were alerted to take samples of all butterflies seen. Moreover, *P. rapae* flies near the coast in southern California in every month of the year (Emmel and Emmel 1973). Thus, it is inconceivable that we could have overlooked the cabbage white even at a low population density.

Known from Santa Barbara as early as 1916 (Coolidge 1923), it seems unlikely that this butterfly has never immigrated to S.C.I., yet there appear to be no records prior to 1969. There are no specimens in the Los Angeles County Museum of Natural History from the 1939–41 faunal survey (S. Miller *in litt.*), and none could be located in the U.C. Riverside collection, which has some general insect survey material from the fieldwork associated with the biological control of prickly pear cactus on the island. Of course it is possible that *P. rapae* is such a weedy and ubiquitous insect that no voucher specimens were retained by early collectors who may have observed it.

Subsequently *Pieris rapae* has become common in weedy habitats along the main water courses in the Central Valley and Prisoners Harbor Creek. Specimens were collected in early August 1969, by D. B. Weissman; C. L. Remington (*in litt.*) encountered the species in the early 1970s; and we found it numerous in September 1978. If the species had been unable to cross the channel on its own for nearly 90 years following its establishment in California, it is possible that it was inadvertently introduced, perhaps as larvae on garden nursery stock, during the late 1960s. Why this event did not occur during a much earlier ranching era is a mystery.

Pyrgus communis albescens Ploetz

The western checkered skipper is a homodynamic insect that occurs throughout southern California, especially in weedy areas where *Malva* is adventive. Thus it should not have been surprising when we found this species at scattered places on S.C.I.—Cañada Cervada near the western end, Willow Cove on the south shore, and Prisoners Harbor on the north shore—during 26–29 September 1978. Those collections, however, evidently were the first records of *P. communis* on the island.

We did not encounter this species during our 1966–69 trips, when 26 species of butterflies were taken; D. B. Weissman did not collect it among 16 species taken in early August 1969; and G. A. Gorelick failed to record it among 22 species logged in June 1978 (Langston 1980 and *in litt.*). In addition, S. E. Miller (*in litt.*) did not find S.C.I. specimens in the LACM from the 1939–41 Channel Islands Biological survey.

Spring and summer collections cannot be ruled out as seasonally asynchronous unless a markedly differing voltinism has been fixed genetically in the island population, limiting it to a fall flight. On the mainland, *P. communis* has been recorded from every month and commonly flies from February to October (Emmel and Emmel 1973). Individuals are often seen by mid-March even in the San Francisco Bay area.

Moreover, data from other Channel Islands suggest a restricted flight period is unlikely. *Pyrgus communis* has been known on Santa Catalina Island at least since 1932 (LACM) and has been taken during the winter (Meadows 1936). There are specimens from Santa Rosa Island taken in 1939 and 1941 according to Miller (*in litt.*) who encountered this species on his earliest visits to other northern

Channel Islands, on tiny, remote Santa Barbara I. in June 1978, and on East Anacapa in August 1978. Therefore failure of *P. communis* to appear in S.C.I. collections prior to September 1978 is perplexing. The widespread distribution on the island at that time suggests either that populations expand in numbers and in range as the season progresses, or that the species had quite recently (since June 1978) reached the island, rapidly populating various parts of it. Neither hypothesis seems plausible, considering the overall distribution and voltinism of this insect.

Laetilia coccidivora (Comstock)

This pyralid moth was described from Washington, D.C. and is widespread through the southern and southwestern states, including southern California (Heinrich 1956). The larvae feed on various Coccidae, especially cochineal scales on cactus, and occasionally on the flowers of prickly pear.

Cochineal insects, species of *Dactylopius*, were introduced to Santa Cruz Island from the mainland between 1940 and 1951 for control of prickly pear cactus (Goeden et al. 1967). Successful introductions apparently occurred in 1951 with colonies from Hawaii, via Riverside, of cochineal insects descended from a series of introductions from Mexico to Australia beginning in 1927. Distributions of *Dactylopius*-infested *Opuntia* pads from the ranch headquarters area of the original introduction were carried out in 1955–1960, and observations from 1961 to 1966 indicated that *Dactylopius* had spread throughout the island and had effected substantial control of the cactus (Goeden et al. 1967). Goeden and his coworkers attributed the success of this biological control agent in part to the apparent exclusion of two of its natural predators, a coccinellid beetle (*Hyperaspis*) and *Laetilia coccidivora*. The latter was encountered at all mainland stations where *Dactylopius* was surveyed, but it was absent from their collections on Santa Cruz Island, although Goeden et al. admit the inadvertent introduction of these predators during the course of the biological control work could not be ruled out.

Laetilia coccidivora was first collected on Santa Cruz Island in October 1972, when C. L. Remington took a series of adults at lights at the U.C. field station. He collected another series in August 1974 at the same station, and I took them in blacklight traps at all sites sampled in late September 1978. Larvae collected by D. S. Green in June 1977 produced adults in mid-July. One *Dactylopius*-infested *Opuntia* pad I collected in late September 1978, at Willows Creek, produced adult *Laetilia* in October and November and again the following May and June (JAP 78J7). Heinrich (1956) cites collection dates throughout the year in Texas and Arizona and for March, October and November in southern California. The life cycle does not seem to be carefully documented, but the records suggest either a bivoltine pattern or continuous generations are possible in warmer areas.

In addition to our negative evidence from blacklight trapping at the field station in May and June 1966, Remington sampled a diversity of microlepidoptera at the station in late July 1967 and 1968, and mid-August 1968, but did not find *L. coccidivora*. Presuming that population numbers build up during the season and that adults appear at lights only in exceptionally warm weather, our spring and June work could be ruled out as adequate for discovery of this species. However, the moth sampling by Remington in July and August 1967–1968, should have revealed *Laetilia*, had it become as abundant in the area as collections during 1972–1978 indicated.

It appears that *Laetilia coccidivora* was introduced to Santa Cruz Island during the biological control program in 1951–1961, or by some other means subsequently. Probably the moth did not build up in population numbers or was localized on the island in areas remote from the vicinity of the ranch headquarters and field station, until the early 1970s.

The deleterious effect on *Dactylopius* as a biological control agent of prickly pear cactus by appreciable levels of this predaceous moth have yet to be assessed. My rearings produced 15 adult *Laetilia* and one Chalcidae, presumably a parasitoid of *Laetilia*, from a single *Opuntia* stem.

Platynota stultana Walsingham

The "omnivorous leaf roller" was described in 1884 from Sonora, Mexico, and its native range probably included adjacent parts of the southwestern U.S., as it was collected in Cochise County, Arizona in the 1890s by F. H. Snow (specimens, AMNH). As the common name implies, a vast array of larval hosts has been recorded (e.g., Atkins et al. 1957), most of which are in nursery and agricultural situations, whence the insect has expanded its geographical range during the past 80 years. *Platynota stultana* seems not to be native in cismontane southern California because it was not encountered by Coquillett and others in the early years of citrus investigations, yet it had become a pest of citrus by 1913 (Woglum 1920). The earliest record in California I have seen is at La Mirada, Los Angeles County, where it was reared from tomato in 1898 (specimen, NMNH). By 1913–1915, *P. stultana* had become an economic problem in various citrus and cut flower growing areas of southern California (Woglum 1920; Bohart 1942).

The species reached coastal Santa Barbara County by 1940, although the date of initial establishment and continuous residency there is unknown. There is one record for Carpinteria (40 km NW of S.C.I.) (NMNH), and *P. stultana* was reared from larvae collected by Henne on Anacapa Island during the LACM Channel Islands Biological Survey in 1940. About 1960 this species apparently underwent a change in physiological tolerance and during the following several years greatly expanded its geographic and ecological range in California (Powell 1981).

Adults of *Platynota stultana* readily come to lights, so presence of a population is easily detected. I collected the moths at Goleta (45 air km N of S.C.I.) in June 1965 and on both Santa Catalina and San Clemente Islands on my first visits to them, in April 1968 and March 1972, yet no collections were made on Santa Cruz Island prior to 1975. The adults fly virtually throughout the year in southern California, so that seasonal exclusion cannot be the reason.

The first record for S.C.I. was a female taken at UV light at the field station in late July 1975, by C. L. Remington and R. Priestaf. We found the adults common at lights around the station, and one was taken in a blacklight trap at Prisoners Harbor in late September 1978. Therefore it seems probable that *Platynota stultana* was introduced in the early 1970s, possibly via cut flowers or potted nursery plants, and is established on the island.

This species has been reared from *Eriogonum grande*, a native endemic plant, at Isthmus Station on Santa Catalina Island, by G. A. Gorelick, so it will be interesting to monitor its invasion of the native flora on Santa Cruz. There are no undoubted records of the occurrence of *P. stultana* in native plant communities on mainland California, except in desert areas (Goeden and Ricker 1976a). The same authors (1976b, and earlier references) encountered the omnivorous leaf-

roller on several native ragweed species (*Ambrosia*) in cismontane southern California, but it appears that most or all these records are from roadsides, abandoned cropland and similar artificial expansions of *Ambrosia* habitat. It was not discovered on *Ambrosia chamissonis* in native situations by Goeden and Ricker or by me on Santa Cruz Island or at many other coastal sand dune localities.

Discussion

Probability of introduction by man.—There is reasonable evidence to indicate the recent introduction by man of 3 of the species recorded here, *Forficula auricularia*, *Laetilia coccidivora*, and *Platynota stultana*. The sudden, recent appearance of the remaining two butterflies, however, is not easily interpreted. No data are available to explain the long period during which they apparently failed to colonize.

Pieris rapae could have been imported on cabbage or other garden crucifers during the late 1960s, but an immigration via this route much earlier, when production and transport of agricultural products were less controlled, seems more plausible. *Pyrgus communis* is an unlikely candidate for accidental transport by man. Both species seem to be sufficiently strong fliers to have made the trip on their own many times during the 80–100 years their weedy hostplants surely must have been available on the island. Both have been resident for more than 50 years on Santa Catalina, a comparable sized island situated the same distance off the southern California coast (Meadows 1936).

Depauperate nature of the fauna:—One of the most fascinating aspects of the Channel Islands fauna is its depauperate nature. While reasonable hypotheses can be proposed to explain absence of many species that occur on the adjacent mainland, others seem missing by chance. In the best documented insect group, the butterflies, Miller (*in litt.*) has recorded about 70 species in an area the size of S.C.I. in the Santa Ynez Mountains-Santa Barbara coastal shelf, but of these, only 33 have been discovered on S.C.I., only 40 km away (Langston 1980; present data). Among the absentees, some can be theorized as either lacking from the original community at the time of separation from the mainland or subsequently eliminated and too sedentary to have immigrated (e.g., the lycaenids *Euphilotes battoides* and *Philotes sonorensis*, which have been demonstrated to possess low vagility rates, (Arnold 1980; Keller et al. 1966). Others might be missing because their restricted larval food preferences are for plants not found or too limited on the island to maintain insect populations (e.g., *Colias eurydice* on *Amorpha californica*, *Habrodais grunus* on *Quercus chrysolepis*). Overgrazing by feral sheep in dry years might account for the paucity of grass feeding Lepidoptera, explaining the absence of 6 or 7 Santa Barbara Hesperiinae and the Satyrid *Coenonympha california*, which occurs in weedy areas throughout most of California.

On the other hand, non-residents include several widespread, apparently vagile butterflies whose larval hosts are common on S.C.I. For example, *Papilio rutulus*, one of California's largest butterflies, and *Limenitis lorquini*, seem imponderably absent from suitable appearing willow-lined creek habitats; *Phyciodes mylitta*, a homodynamic species which feeds on weedy and native Asteraceae, occurs abundantly in disturbed situations at low elevations throughout the state north of Santa Barbara but not on S.C.I.; *Incisalia iroides* is polyphagous on native plants, both monocot and dicot, and would seem to be as likely a colonist as another lycaenid,

the resident *Celastrina argiolus*, which has similar larval food preferences. Four *Eriogonum* (Polygonaceae) specialists, the lycaenids *Lycaena gorgon*, *Euphilotes battoides*, *E. enoptes*, and *Apodemia mormo*, do not occur on S.C.I., yet all live along the coast of the mainland, often in sympatry. Among *Cercocarpus* (Rosaceae) feeding Lepidoptera, two moths, *Acleris folianus* (Tortricidae) and *Ethmia discostrigella* (Oecophoridae) are common on S.C.I., but a butterfly, *Strymon tetra* (Lycaenidae) is absent. All 3 are sympatric in scattered parts of California, such as at San Diego. Many such examples could be listed.

Compliance to island biogeographic theory.—Orthoptera on the Channel Islands conform fairly well with the species numbers/area aspects of island biogeographic theory (Weissman and Rentz 1976), and species numbers of butterflies are remarkably similar (S. Miller *in litt.*). Preliminary sampling of S.C.I., San Nicolas, Santa Catalina, and San Clemente islands indicates that diversity for Lepidoptera as a whole will follow this pattern. Thus it is tempting to suggest that the Channel Islands possess dynamic equilibrium levels in insect species, that an extinction curve-immigration curve intersect has been reached. According to this hypothesis, the low species numbers compared to the mainland are a function of island area and ecological diversity. Theoretically, aspects of community complexity, including competitive displacement, interact to maintain the insect fauna near its present diversity. In birds, area by itself is a relatively poor predictor of numbers of species on the Channel Islands compared to ecological parameters such as numbers of native plant species (Power 1972). For insects, a list of plant species provides a crude index to potential niche diversity in larval foods in some phytophagous groups but not necessarily in Orthoptera, many of which are scavengers or general plant feeders. The insular fauna of Orthoptera may be at or near equilibrium, with numbers of species related to ecological diversity, expressed by complexity of vegetation types, which is roughly correlated with area. By contrast, in Lepidoptera and other phytophagous insects having many species that depend upon particular plants, extinction and colonization rates presumably are much more sensitive to disturbance, particularly overgrazing and invasion of weeds. Such perturbance favors homodynamic, especially polyphagous species, which are often alien, and these become dominant in population numbers per unit area. Native, host specific species are selected against by elimination or restriction of host plants to small habitat patches. As a result, although insect species numbers may be generally correlated with area and environmental complexity, in most taxa they are likely to be low compared to the original and potential equilibrium levels.

The best documented studies of extinctions and turnover rates of insular animals have concentrated on birds, primarily because they can be censused with confidence, and often long term data are available (e.g., Diamond 1969; Diamond and May 1977; Power 1976). Coincidentally, birds are vagile and presumably more easily capable of immigration than most animals. Therefore the supposition that such turnover rates represent a dynamic equilibrium of the MacArthur-Wilson (1967) interpretation may be valid. With most insects, however, recent extinction rates likely are higher than natural due to decimation of the plant community or to fragmentation of larval host populations. Colonization rates may be low owing to low immigration rates and/or reduced patch sizes of suitable habitat. Thus, the extinction rate in large part is independent of the colonization rate.

mented and reduced the size of many phytophagous insect populations on the island, enhancing chances of local extinction due to natural fluctuations in abundance.

Therefore it is probable that insect diversity has declined since the advent of introduced mammals and weedy plants, and the island's insect fauna is undersaturated. The situation is comparable to defaunation experiments with mangrove islands except the relaxation time required to reach equilibrium (or 90% of equilibrium $t_{0.90}$, of MacArthur and Wilson) is much longer. Feral sheep were removed and excluded from a large portion of S.C.I. during the 1950s, which can be envisioned as the end of the defaunation process, with gradual establishment and expansion of formerly resident and new colonist plants and phytophagous insects having progressed since that time.

The relaxation time for the fauna to return to equilibrium following perturbation (including immigration of alien species), may be very long (examples cited by Simberloff 1974). Thus the insect fauna of S.C.I., and probably most islands inhabited by Western man, may be interpreted as undersaturated and out of equilibrium, a state that will continue indefinitely. Cessation of overt disturbance (grazing, grading, farming, etc.) may mark the beginning of the return to an equilibrium, but immigration effects of the disturbance (colonized weedy plants and animals) prevent return to the original equilibrium and together with differential rates of immigration and abilities to colonize by mainland species that have not yet colonized, preclude return to the original community composition.

Insects that need specific plants as larval food, such as native bunch grasses or *Eriogonum*, may have dropped out of the fauna, and immigration from conspecific populations on the mainland or on nearby islands has not occurred and/or remaining patches of suitable habitat are too limited to have enabled colonization by chance. Homodynamic species that are more vagile and often weed-feeding, such as *Pieris rapae* and *Pyrgus communis*, also may have undergone extinction in times of climatic or grazing stress, but if so, have been able to recolonize.

Thus the insect community of S.C.I. is transitional in species membership, consisting primarily of two cohorts: a) relics of the original California mainland community, and b) species that have been able to colonize in spite of or even because of the disturbance by man. The latter group consists mostly of homodynamic, weed-feeding or polyphagous species, some of which may colonize and disappear periodically. Included are both alien (e.g., *Forficula auricularia* and *Pieris rapae*) and native species (e.g., *Platynota stultana* and *Pyrgus communis*).

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